THE EFFECT OF TURPENTINING ON THE GROWTH OF LONGLEAF AND SLASH PINE

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Longleaf and slash pine have long been recognized as "dual-purpose" trees, a term which is meant to imply that the living trees can be chipped for gum naval-stores products for several years prior to their being felled for wood products. The full significance of this dual use is being realized now more than ever before. The development of the pulpwood industry in the South, simultaneously with the increased appreciation of the needs of the region for other wood products such as poles and sawlogs, has caused the various industries to question whether such dual use is best for their respective interests. Important among the issues considered are the probable effects of turpentining on volume and growth of the timber.

It should be pointed out that turpentining in the past has taken a heavy toll through excessive mortality, especially as the result of wind breakage. The trees were mechanically weakened by deep chipping and by the practice of making deep incisions in the turpentine face for attaching gutters. Also, many trees were further weakened by the activities of the turpentine borer, which usually gains entry through the turpentine face following fires that have removed the protective coating of gum. The following excerpt from a report 1/ by the Southern Forest Survey shows the heavy drain on the total volume and growth on a survey unit of 9 1/2 million acres in northeastern Florida:

> "Although the current turpentining practices in this region are relatively conservative when compared with those in other regions, the naval-stores industry exacts an excessive toll from the forest. As a result of chipping small trees, placing too many cups on some trees, deep chipping, carelessness with fire, and other bad practices, turpentining causes an excessive reduction in rate of growth and an increase in rate of mortality of turpentine pines as well as an actual reduction in sawtimber volume, owing to the scars which result from the work. During 1934, the longleaf-slash turpentine forest in northeastern Florida, if they had not been turpentined, would have produced 210,300,000 board feet (lumber tally) more than they did. This is a part of the price which the region pays for its naval-stores industry. The significance of the loss in annual increment is shown by the fact that it slightly exceeds the combined cut from pine for lumber, ties, poles, piles, and all other wood products during that year. Since it seems inevitable that the naval-stores industry will continue to be an important user of the forests in this region, the outlook for other forest industries will be limited thereby in scope, character, and volume of production."

1/ This report is now in manuscript and will probably be published in 1937 under the title "Forest Resources of Northeastern Florida."

While excessive loss in volume due to turpentining is to be deplored, it should be recognized that naval-stores gum is produced by the tree at the expense of wood, and consequently some reduction in growth during the turpentining period must be expected. Despite the fact that the naval-stores industry has been harassed by widely fluctuating market-prices throughout its history, the use of longleaf and slash pine for the production of naval stores has been, and probably always will be, an attractive business venture. Certainly with prevailing naval-stores lease prices of 3¢ to 8¢ per tree per annum and with the period of turpentining a single tree extending over 10 to 20 years, the timberland owner should not hesitate to turpentine his trees, especially if these same trees, when converted into pulpwood (to use only this one wood-product as an example), bring under current prices less than 10¢ each.

One of the attractive features of the region in which slash and longleaf pine occur, is that integrated forest-product use here seems both possible and practicable; and serious attention is being directed by those interested in the forest resources of the region to develop better forest-management practices. Studies by the Southern Forest Experiment Station have already indicated that excessive loss of volume and growth in turpentined second-growth forests can be averted if the stocking is regulated, if fire is controlled, if the best turpentining practices are used, and if provision is made for early utilization of the worked-out trees. Since it seems reasonable to assume that any forest property under moderately careful management would have a large measure of success in carrying out these measures, the problem then narrows down to the actual retarding effect of turpentining on the growth rate of the tree during, and subsequent to, the process.

The Southern Station is now collecting field data in an intensive study of the effect of turpentining on growth in its many ramifications. Some data were obtained by the writer in 1930, however, and these data, given in table 1, are offered at this time to fill the need for this type of information until results of the more complete study are available. These results, although based on only a few trees from each of several localities in northeastern Florida, are believed to be approximately correct as general averages.

In the 1930 study, 32 slash pines from Bradford, Union, and Columbia Counties, and 23 longleaf pines from Bradford, Union, Hamilton, and Suwannee Counties, all in Florida, were felled, and the growth before and during turpentining was determined by measurements of annual rings. Diameter measurements were made at face height (usually 9 to 10 feet above the ground) and at intervals of 20, 40, 60, and 80 percent of the height along the stem from breast height to the tip. Six radius measurements by periods, before and during turpentining, were made at each cut in order to get an average diameter. The maximum growth-retarding effect of the turpentining occurs in the region above the face, and its influence may be traced well up toward the top of the tree. An interesting fact is that the restricted growth follows the "grain" of the wood; this was true even in trees of twisted grain. Results expressed in terms of percentage rate of volume loss are given in table 1.

It will be noted in table 1 that for both species of pine the average reduction in growth rate (as measured in cubic feet) during turpentining is approximately 27 percent for 1-face trees and about 40 percent for 2-face trees, whether the faces are put on in succession or simultaneously. Stated

in another way, 1-face trees grew 73 percent as fast when worked as they would have grown if they had not been worked, and 2-face trees grew 60 percent as fast. Although no data are available for 3-face trees, they would probably increase in volume during the period of turpentining at about 50 percent of the rate of unturpentined trees.

Table 1. Reduction in rate of cubic-foot volume growth during turpentining in northern Florida

County	First face		Second face		Two faces worked at same time	
	Loss	Basis	Loss	Basis	Loss	Basis
	Percent	Trees	Percent	Trees	Percent	Trees
			Slash			
Bradford	31	11	45	8		
Columbia	20	7	29	3		
Union					38	3
			Longleaf			
Suwannee	23	7	39	3		
Union	21	5				
Hamilton	20	2				
Bradford	34	6				
Averages and totals	27	38	40	14	38	3

The retardation in growth seems to be attributable to two things: (1) a diversion of the tree's photo-synthetic products to gum rather than to wood; and (2) to the checking of translocation and the flow of solutes by the face. This latter effect would, of course, vary with the width of the scar or the amount of girdling of the tree. Following the cessation of turpentining, as the face scars healed over, the growth rate could be expected to return gradually to normal for an unturpentined tree. It is doubtful, however, whether any management plan should contemplate anything other than the immediate cutting of worked-out timber, if this is at all practicable, in view of the excessive losses possible in turpentined timber.

When discussing the effect of turpentining on volume growth, it should be kept in mind that the loss in volume, except for that lost in the butt log in wood removed with the turpentine hack, is simply caused by a reduction of the growth after turpentining begins, and that while the rate of growth for that period may be reduced considerably the loss in volume over the entire life of the tree is, nevertheless, rather small, as the following example illustrates:

A 9-inch longleaf pine 50 feet tall has a cubic volume of 9.1 feet. Growing at the rate of 1 inch in diameter in 5 years it would become a 10-inch tree 55 feet tall at the end of a 1-face or 5-year period if unturpen-

tined. 1/ This represents a total volume at the end of the 5-year period of 12.5 cubic feet or a growth of 3.4 cubic feet for the period. The same tree, if turpentined, would reach a total cubic volume of 11.6 feet, but in addition would produce about 35.7 pounds of gum. The actual loss in total cubic volume of the tree is only about 7 percent. That is, the volume of a crop of 10,000 one-faced trees at the end of a 5-year period is reduced only 7 percent in exchange for which approximately 950 barrels of gum have been obtained.

It should be noted that these results do not permit one to make an unqualified recommendation to turpentine before cutting. In the first place returns from naval stores may not compensate for the loss in high-grade lumber in very large trees. Also it has been observed that old-growth trees, owing largely to their slower growth and greater proportion of heartwood, are more susceptible to damage (e.g., from blue stain and insects) and are more likely to die as a result of turpentining than are young, vigorous trees.

The results do indicate, however, that if conservative naval-stores practices are used and if the young stands are put under fire protection and good management, the loss in wood volume due to turpentining is so low as to be no serious deterrent to naval-stores operations before cutting for the final product.

1/ U.S.D.A. Volume, yield, and stand tables for second-growth southern pines. U. S. Dept. Agr., Office of Forest Experiment Stations. Misc. Pub. No. 50. September 1929.